# The Identification of Response of Stock Returns to Monetary Policy Actions Using Market-Based Measures of Monetary Policy Shocks.

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Abstract: We investigate two related approaches to dealing with the possible joint response bias in using Kuttner's approach to identifying monetary policy's impact on stock returns – the methodology recently suggested by Thornton, and use of intraday data. For all three methods, we find the estimated impact of monetary policy actions on stock returns is negative and statistically significant, and we find that this negative impact is magnified during bear markets and during recessions. We find point estimates indicating a positive joint response bias using Thornton's methodology, although these are not statistically significant. We find that intraday data provide the same qualitative pattern of results, but the estimated magnitude of the impact of monetary policy on stock returns is smaller compared to either approach using daily data.

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## 1. Introduction.

Market-based measures of monetary policy shocks have been used at least since Kuttner (2001). Kuttner used changes in Federal Funds Rate Futures prices to infer the surprise in the Federal Open Market Committee interest rate announcement, and used a regression of interest rates on this announcement surprise measure in order to identify the impact of monetary policy on interest rates.

One concern with this widely used procedure is the possibility that an unobserved variable might jointly impact both the announcement surprise measure and the dependent variable – here interest rates. This would lead to bias in our estimated impact of monetary policy on interest rates, a bias that some have labeled the 'joint-response bias' in this literature.

Much of the work using market measures of monetary policy have been at the daily level, with the daily change in interest rates compared to the daily change in the Federal Funds Rate Futures price. One proposed solution to the joint-response bias problem is to use higher frequency data, in this case intraday data, and to measure the policy surprise and the change in interest rates in a narrow window around the FOMC announcement. The idea is that, by using a much smaller part of the day, the chance of some other unobserved variable jointly impacting both the Federal Funds Rate Futures price and the market interest rates is much reduced, so that use of higher frequency data at least attenuates this joint response bias.

More recently, Thornton (2013) has suggested an alternative approach to mitigate the joint response bias. The above approaches, whether using daily data or intraday data, both use data only from the FOMC announcement day. Kuttner's original approach looked at the daily change in interest rates and the daily surprise change in the Federal Funds Rate Futures price. The use of intraday data uses data in a narrow window – maybe 30 minutes – around the announcement. Both approaches are event studies, only considering data at the FOMC events, and ignoring all other days in the sample. Thornton's alternative is to use daily data, but all of the daily data, and to construct measures of the change in interest rates and the surprise change in the Federal Funds Rate on each day of the sample, not just the FOMC event dates. Thornton then runs a regression where the dependent variable – the change in an interest rate – is regressed on the measure of the surprise change in the Federal Funds Rate and on an indicator for an FOMC event interacted with the measure of the surprise change in the Federal Funds Rate. The coefficient on this latter term is the measure of the impact of monetary policy on interest rates, while the surprise change in the Federal Funds Rate on all other days serves as a control variable for the joint-response bias. Thornton (2013) demonstrates the ability of this methodology to reduce the problematic joint-response bias.

Here we use the three approaches outlined above to estimate the impact of monetary policy on stock returns, and we compare our results to see if there is evidence of the joint-response bias in our estimates of the impact of monetary policy on stock returns. We also compare the two approaches suggested to mitigate this problem.

Importantly, the joint response bias that Thornton discusses can be either negative or positive, depending on the correlation of stock returns and the federal funds rate surprise with the unobserved variable. Stock returns and the federal funds rate futures prices are likely to respond to similar unobserved news events impacting financial markets, making the joint response bias a potentially important issue.

We will follow Thornton (2013) and estimate the following equation using data from every day in the sample and not just on FOMC event dates. We calculate the surprise change in the federal funds rate futures each day of our sample, and estimate the following equation:

$$R_{i,t} = \beta_0 + \beta_1 \Delta f_t^u + \beta_2 \Delta f_t^u FOMC_t + \varepsilon_{i,t} \qquad (1)$$

where $\Delta f_t^u$ denotes Kuttner's (2001) market-based measure of unexpected federal funds rate changes, and $FOMC_t$ denotes a dummy variable that is 1 on days with monetary policy events and zero otherwise.

The coefficient $\beta_1$ denotes the joint response of stock returns and market-based measures of monetary policy shocks to ambient news, and $\beta_2$ denotes the joint response of stock returns and the market-based measure to unexpected policy events. In other words, the coefficient $\beta_2$ reflects the marginal change in stock returns associated with an unexpected policy event. If $\beta_2$ is not significantly different from zero, the market's reaction to a surprise monetary policy event is no different from its reaction to changes in the federal funds rate due to ambient news.

## 2. Data

Our analysis is based on Federal Open Market Committee (FOMC) decisions, and our data set contains information on FOMC decisions on the Federal Funds Rate target from 103 scheduled FOMC meetings over the period March 1995 through December 2007.[1] We obtain the exact date and time of the FOMC releases to use when measuring monetary policy surprises with intraday day. Our stock return data is calculated from the S&P 500 index.

**Measure of Daily Surprise Kuttner shock**

We measure the surprise monetary policy shock --- and actually the surprise

[1] The Federal Funds Rate was targeted at a range of 0 – 0.25% by late in 2008, and was engaged in the first of an ongoing series of large asset purchases, so-called non-traditional monetary policy. Nontraditional monetary policy, including large scale Federal Reserve System asset purchases, especially at the zero lower bound of the Federal Funds Rate, implies that the Federal Funds Rate is no longer a satisfactory single indicator of monetary policy actions. Thus we end our sample at the end of 2007.

change in the Federal Funds rate each day -- using Federal Funds Rate Futures prices and the method proposed by Kuttner (2001). Kuttner used market data on Federal Funds futures contracts traded on the Chicago Board of Trade to extract a measure of the surprise change in the Federal Funds Rate on FOMC event dates. The idea is that the Federal Funds Rate Futures contract price on the day prior to the FOMC announcement reflects the market's expectation of the FOMC announcement on the succeeding day. The futures contract price on the day of the FOMC announcement, and especially its change from the previous day, reflects information in the announcement. The difference in the futures contract prices at date t-1 and date t can be used to calculate the change in the Federal Funds Rate that is a surprise to the market. The actual calculation must be scaled to take account of the fact that the futures contract settlement price is based on the monthly average Federal Funds Rate. For a change in the Federal Funds Rate target taking place on day t of month s, the surprise target funds rate change is calculated as the 1-day change in the spot-month futures rate. This change in the futures rate is scaled up by a factor related to the number of days in the month affected by the change, because the contract's settlement price is based on the monthly average Federal Funds Rate. That is, the unanticipated change in the Federal Funds Rate target is calculated as:

$$\Delta f_t^u = \frac{m}{m-t}(f_{s,t}^0 - f_{s,t-1}^0) \qquad (2)$$

where $\Delta f_t^u$ is the surprise Kuttner shock, $f_{s,t}^0$ is the spot-month futures rate, and $m$ is the number of days in month $s$. In the case where the target rate change occurs on the first day of the month, we replace $f_{s,t-1}^0$ with $f_{s-1,m}^0$. Here $f_{s-1,m}^0$ denotes the 1-month futures rate from the last day of the previous month. In order to avoid the large noise at the end of the month, if the target rate change falls within the last seven days of the month we use the unscaled 1-month futures rate change instead of the change in the spot-month rate.

Traditionally this methodology is applied to the FOMC event dates, so the surprise change in the Federal Funds Rate is calculated only on those dates. In order to apply Thornton' s methodology we calculate the surprise change in the Federal Funds Rate on each day of our sample not just FOMC event dates.

**Measure of Intraday Surprise Kuttner shock**

When using intraday data we construct an intraday version of the Kuttner surprise by calculating the change in the Federal Funds Rate Futures prices in a narrow window around the FOMC announcement time, and then inferring the surprise change in the Federal Funds Rate in the announcement. We use various alternative windows, and here will report only for a window of 40 minutes width. Other window widths (e.g. 25 minutes wide, from 5 minutes before to 20 minutes after the announcement) gave quite similar results. The intraday Kuttner surprise to the federal funds rate target in a 40-minute window is calculated as:

$$\Delta f_{t,40}^{u} = \frac{m}{m-t}(f_{t,\tau+30} - f_{t,\tau-10}) \quad (3)$$

where $\Delta f_{t,40}^{u}$ is the 40-minute window surprise target rate change for the FOMC announcement on day $t$, $f_{t,\tau+30}$ is the spot-month futures rate at time on day t for time $\tau + 30$ where τ is the announcement time, m is the number of days in the month, and $f_{t,\tau-10}$ is the spot-month futures rate at time $\tau - 10$.

**Measure of S&P 500 Index Stock Returns**

Our daily stock returns are calculated for the S&P500 index using data from the CRSP (the University of Chicago's Center for Research in Security Prices) data set. We use the closing price on the day prior to the FOMC announcement day and the closing price on the day of the FOMC announcement.

For intraday returns, we again use the S&P 500 index, using intraday data from the Tick Intraday Futures & Indices database. The Tick Intraday Futures & Indices database is a collection of intraday trades and quotes for many indices and commodities. We calculate intraday returns within the specified windows surrounding FOMC announcement times from index values in the Tick Intraday Futures & Indices database. Returns are calculated using log differences. Thus for the intraday 40 minute window we calculate the 40-minute stock return as:

$$R_{t,40} = 100 * (\log P_{t,\tau+30} - \log P_{t,\tau-10}) \tag{4}$$

where $R_{t,40}$ is the 40-min interval return on S&P 500 index on day *t* surrounding an FOMC announcement at time $\tau$. Here $P_{t,\tau+30}$ and $P_{t,\tau-10}$ represent the stock prices for trades at time $\tau + 30$ and $\tau - 10$ on day *t*, respectively. Importantly, these returns are returns over a 40 minute period, so comparisons to daily returns used in the event-study methods should be made with that in mind.

**Measure of Bull and Bear Markets**

We look at differential impacts of monetary policy in bull and bear markets, and also in recessions and expansions. While we use the NBER definition of recessions, we need to define bull and bear markets. Our definition follows Pagan and Sossounov (2003), a definition also used in Jansen and Tsai (2010). Pagan and Sossounov develop a classification of markets into bull and bear that is mutually exclusive and exhaustive. A peak will always follow a trough and vice versa, and the event space is divided into bull and bear market periods. A bull market is said to occur when the stock index is located between the trough point and the peak point, including the peak, and a bear market occurs otherwise. Figure 1 provides a graph of bull and bear markets over our sample. This graph clearly illustrates stock market was in a bear market from September 2000 until the trough in September 2002, and a bull market occurs otherwise.

**Measure of Expansion and Recession States**

We use the decision of the Business Cycle Dating Committee of the National Bureau of Economic Research to define Apr 2001 to Nov 2001 as a recession period during our sample. Otherwise an expansionary state occurs.

## 3. Descriptive Statistics

Table 1 provides descriptive statistics for the data used in our three estimation methods. Method 1 is the traditional daily event study methodology based on calculating Kuttner surprises. Method 2 is the event study methodology based on calculating Kuttner surprises on intraday data, ideally reducing the joint response bias. Method 3 is Thornton's method, a time series methodology using daily data, Kuttner shocks calculated for all days, and an indicator for the response of stock returns to Kuttner shocks on FOMC event dates.

Methods 1 and 2 are based on 103 monetary policy events. In the first part of Table 1 we report the number of events – 103 – as well as the average Kuttner shock calculated on these 103 event dates, -.005, and the average stock index return on these 103 days, 0.24%.

Method 2 looks at a narrow slice of time on the same 103 event dates. In our 40-minute window, the average Kuttner shock is -.110, and the average stock return is -.093%. We also provide statistics for the average stock return from the close of day prior to the event date through the beginning of our event window on the event day, and the average stock return from the end of the event window until the market close on the event day. We will say more about these statistics later in the paper.

Method 3 looks at 3,231 days of data spanning our sample from March 1 1995 – December 31 2007. The average Kuttner shock over all these days is much lower than on the event days, -.001, and the average daily stock return is 0.001%. Clearly much more is happening on the 103 FOMC meeting days, on average, than on the trading day when the FOMC does not meet.

We have 154 months of data in our sample, with 103 FOMC dates. During our sample we have 25 months when we classify the stock market as being in a bear state, just under one-sixth of our sample. We have only 8 months when we classify the state of the business cycle as being a recession, or just over five percent of our sample.

**4. Econometric Specifications**

Our first look is to use event-study methodology with daily and intraday data to respectively investigate the linear relation between stock returns and market-based measure of unexpected target changes by estimating equation (5):

$$R_t = \beta_0 + \beta_1 \Delta f_t^u + \varepsilon_t \tag{5}$$

Again, this equation will be estimated using daily data, and again using our intraday data, all for the 103 FOMC event days.

Our second look is to employ's Thornton's methodology to estimate the impact of monetary policy using daily time series data to control for the possible "joint-response" bias. For this we estimate equation (6):

$$R_t = \beta_0 + \beta_1 \Delta f_t^u + \beta_2 \Delta f_t^u FOMC_t + \varepsilon_t \tag{6}$$

Here $FOMC_t$ denotes a dummy variable that is 1 on days with monetary policy events and zero otherwise. Coefficient $\beta_1$ measures the effect of the surprise change in the Federal Funds rate (the Kuttner shock) on all days in our sample. Coefficient $\beta_2$ measures the effect of these surprise changes in the Federal Funds rate when they occur on an FOMC meeting day. This coefficient will be our estimate of the monetary policy impact on stock returns.

We also use these three methods to examine how the impact of monetary policy might be state dependent. We look separately at two state variables. One is the state of the stock market, bull or bear. The other is the state of the economy, expansion or recession.

For our two event-study methodologies, using either daily data or using intraday data, we estimate the following equation (7):

$$R_t = \beta_0 + \beta_1 \Delta f_t^{\,u} + \beta_2 \Delta f_t^{\,u} State_t + \varepsilon_t \qquad (7)$$

Here $State_t$ is a dummy variable for a bear market, or a dummy variable for a recession. Here when the state variable is the state of the stock market, the impact of monetary policy in a bull market is measured by $\beta_1$, and the impact of monetary policy in a bear market is measured by $\beta_1 + \beta_2$. Alternative, when the state variable is the state of the business cycle, $\beta_1$ measures the impact of monetary policy during an expansion, and $\beta_1 + \beta_2$ measures the impact of monetary policy during a recession.

Finally, we apply Thornton's methodology by estimating equation (8), which allows the state of the stock market, or alternatively the state of the business cycle, to alter the impact of monetary policy on stock returns.

$$R_t = \beta_0 + \beta_1 \Delta f_t^{\,u} + \beta_2 \Delta f_t^{\,u} FOMC_t + \beta_3 \Delta f_t^{\,u} State_t + \beta_4 \Delta f_t^{\,u} FOMC_t State_t + \varepsilon_t \qquad (8)$$

Here $\beta_2 + \beta_4$ measures the effect of monetary policy on stock returns during a bear market (alternatively a recession period), and $\beta_2$ measures the effect of monetary policy on stock returns in a bull market (alternatively an expansion period.)

**5. Empirical Results.**

Table 2 reports results from estimating equation (5) using daily and intraday stock returns. Estimates of $\beta_1$ are estimates of the impact of the Kuttner shock on stock returns, estimated with a daily event window and with a 40 – minute intraday window.

Given standard identification assumptions, these are estimates of the impact of monetary policy on stock returns. With our daily data our estimate of $\beta_1$ is -4.880, indicating that a 1% increase in the Federal Funds Rate results in a -4.880% change in stock returns. With intraday data our esimate is -3.793, indicating that a 1% increase in the Federal Funds Rate results in a -3.793% change in stock returns. Both estimates are statistically significant at the 1% significance level.

Table 3 reports results from applying Thornton's methodology. The estimate of the coefficient on the control for the joint response bias, $\beta_1$ is 1.439 but not statistically significant. This coefficient indicates that stock returns and Kuttner surprises are positively correlated on non-FOMC days, suggesting that the joint response bias reduces the point estimate of the impact of monetary policy on stock returns. The estimate of $\beta_2$ is -6.652 and statistically significant. Thus we estimate that a 1% increase in the Federal Funds Rate reduces stock returns by 6.652%. The estimated impact is about one-third larger than the estimated impact of monetary policy using daily data and the typical event-study framework, and about two-thirds larger than the estimated impact of policy using the intra-day data in the event study framework. Thus the two approaches suggested to deal with the joint response bias result in estimates that move in opposite directions relative to the traditional Kuttner approach.

We also investigate how the state of the stock market, or the state of the business cycle, impacts the response of stock returns to monetary policy. In Tables 4 and 5 we report results for the impact of monetary policy in bull and bear markets. In Table 4 we estimate from daily data that the impact of monetary policy on stock returns in a bull market is -3.063 but statistically insignificant, while the impact in a bear market is -16.044 and statistically significant at the 1% level. Further, a test of the hypothesis that these two estimates are the same has a p-value of about 2%, indicating we would reject this hypothesis. It seems that monetary policy has a much larger impact on stock returns in a bear market.

Table 4 also reports estimates of the impact of monetary policy from intraday data, and while the pattern of results is similar the estimated magnitude in a bear market is much lower using intraday data. We estimate that the impact of monetary policy in a bull market is -3.194 and statistically significant at the 10% level, while the impact of monetary policy in a bear market is -6.011 and statistically significant at the 1% level. A test of the hypothesis that these impacts are identical across states has a p-value of .173 and hence would not be rejected. Thus the intraday data finds a much smaller impact of monetary policy in a bear market compared to the estimate from daily data.

Table 5 reports our estimates of the bear market/bull market differential using the Thornton methodology. Here we estimate that the impact of monetary policy in a bull market is -2.915 and statistically insignificant, while the estimated impact in a bear market is -18.140 and statistically significant at the 1% level. Further, a test of the hypothesis that these two impacts are identical across state has a p-value of just under 1%, and hence would be rejected. The coefficients that control for the joint response bias are statistically insignificant.

Our various estimates conditioned on the state of the stock market follow the general pattern we found with our unconditional estimates. That is, estimates from our daily data for the impact in recessions find a much stronger impact of monetary policy on stock returns compared to either of our estimates using our intraday data. Thornton's methodology finds a stronger impact of monetary policy than the traditional Kuttner approach, while the intraday data indicates a much weaker effect (though still significant statistically and economically).

Our final results examine how the state of the business cycle changes the magnitude of the impact of monetary policy on stock returns. Table 6 reports results, using daily data, that the estimated impact of monetary policy on stock returns in an expansion is -4.378 and statistically significant at the 5% level, while the impact in a recession is -9.186 and statistically significant at the 1% level. The p-value for the hypothesis that these impacts are identical across state is .180, indicating that this hypothesis would not be rejected. For our intraday data, we estimate the impact of monetary policy during an expansion as -3.663, statistically significant at the 5% level, and the impact during a recession as -4.531, statistically significant at the 1% level. The hypothesis that the impact is the same across states is not rejected – the p-value is 0.622. Finally, using Thornton's methodology, reported in Table 7, we estimate the impact of monetary policy in an expansion as -3.917 and statistically insignificant, the impact during recessions as -12.499 and statistically significant at the 1% level, and the p-value for the hypothesis that the impact is constant across states is .08, indicating we would not reject at the 10% significance level. We find no statistically significant evidence of a joint response bias.

Again, we find that with daily data Thornton's approach indicates a stronger response to monetary policy actions than Kuttner's traditional approach, while using intraday data we find a weaker response to monetary policy actions. Again, stronger or weaker refer to magnitude, as all results are statistically significant.

Overall, our results tell a consistent story. Monetary policy has a strong negative impact on stock returns. Our estimates with daily data, whether used in the event study framework or in Thornton's approach, are larger in magnitude than our estimates using intraday data. We find that monetary policy has a much stronger negative impact on stock returns in a bear market compared to a bull market. Again, we find that our estimates of the magnitude of the impact of monetary policy on stock returns in a bear market is much larger using daily data compared to intraday data. Finally, we find that monetary policy has stronger impacts on stock returns when the economy is in a recession compared to when the economy is in an expansion. We also find the general pattern that the estimated magnitude of the impact in a recession is larger when we use daily data compared to intraday data.

We also find no statistically significant joint response bias, although our unconditional point estimate indicates an overall positive bias, and our conditional point estimates indicate a positive bias in the conditional estimates when we are in a bear market, or a recession.

What can be made of the conflicting results regarding the sign of the joint response bias indicated by the two approaches, the Thornton methodology applied to daily data and the intraday data approaches? In Table 1 we show that stock returns on event days average 0.240%, with 0.325% occurring prior to the event window, -0.093% during the event window, and almost zero occurring after the event window. Further, the average stock return from all days (non-event days and event days) is -0.001%, again almost zero. Recently Lucca and Moench (2013) have addressed this issue, labeling it "pre-FOMC announcement drift," and after an extensive investigation they pronounce this phenomenon a continuing puzzle. For our purposes, this puzzle clouds the issue of the relative success of the two methods for dealing with the joint response bias, as the so-far unexplained sizable stock returns on FOMC days pre-event window clearly impact estimates of the impact of monetary policy in any daily data approach including Thornton's methodology, while this phenomenon does not (directly) impact estimates based on the narrow event window. Whether we want the policy impact to include the pre-announcement drift is an open issue, the resolution of which will depend on the resolution of the pre-FOMC announcement drift puzzle.

## 6. Conclusion

We investigate the using Thornton's methodology to correct for a possible joint response bias in the estimated impact of monetary policy actions on stock returns, as an alternative to using intraday data. We find a negative impact of monetary policy on stock returns, an impact magnified during bear markets or during recessions. We find point estimates indicating a positive joint response bias, but these are not statistically significant. Thornton's approach and the event study approach using daily data provide similar estimates of the impact of monetary policy on stock returns. Intraday data provide the same qualitative pattern of results, but the estimated magnitude of the impact of monetary policy on stock returns is smaller using intraday data compared to either approach using daily data.

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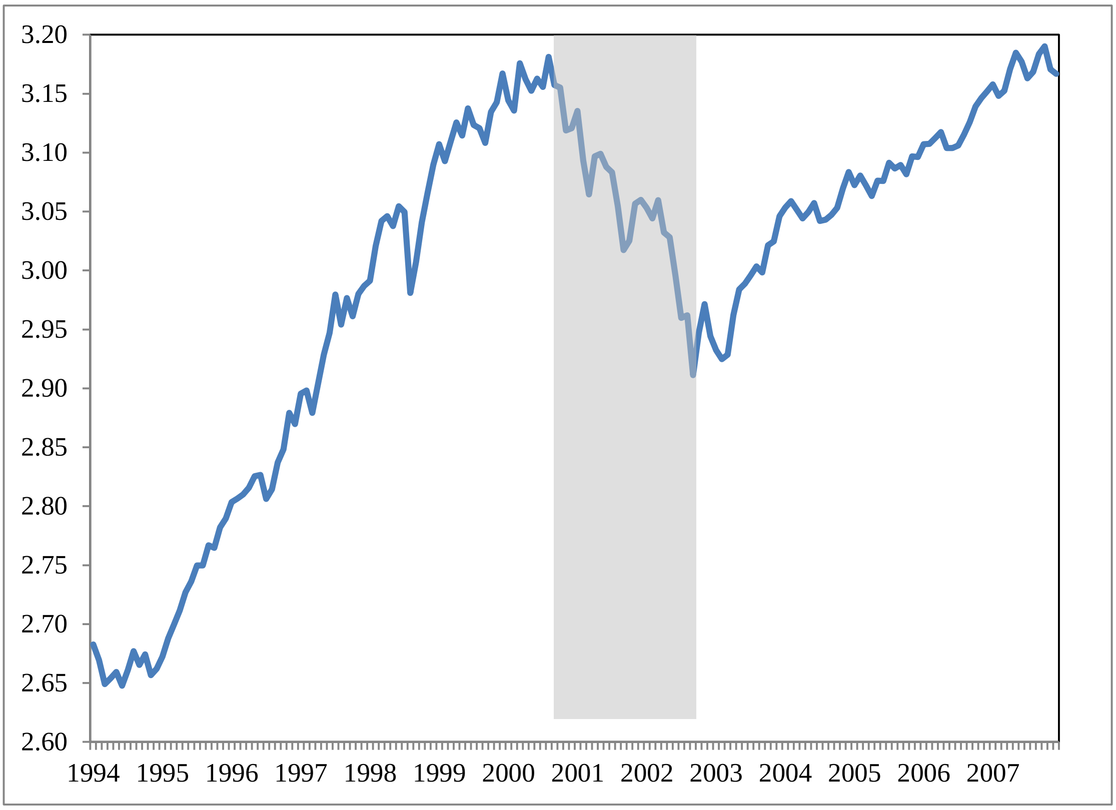
Figure1: Bull and Bear Markets, January 1994 Jan – December 2007.




The shaded areas underneath the stock market index represent bear markets. The y-axis is the log of the S&P 500 index. Pagan and Sossounov's method identifies market peaks as August 2000 and Oct 2007; market troughs are June 1994, and September 2002. Bull markets are trough to peak, bear markets are peak to trough.

Table 1: Descriptive Statistics (Sample Period: Mar 1 1995 – Dec 31 2007)

**Method 1: Event Study Methodology---Daily Data**

| | |
|---|---|
| The Number of FOMC Meeting Days | 103 |
| Mean Value (Std Deviation): | |
| Surprise Federal Funds Rate Change | -0.005(0.051) |
| S&P 500 Stock Returns (%) | 0.240(0.989) |

**Method 2: Event Study Methodology---Intraday Data**

| | |
|---|---|
| The Number of FOMC Meeting Days | 103 |
| Surprise Federal Funds Rate Change within 10-30 window | -0.110(0.498) |
| S&P 500 Stock Returns (%) -- Previous day's close to 10 minutes prior to the announcement | 0.325(0.586) |
| S&P 500 Stock Returns (%) – within the 10-30 window | -0.093(0.525) |
| S&P 500 Stock Returns (%) -- 30 minutes after the announcement to market close | 0.000(0.008) |

**Method 3:Joint-response Bias Methodology---Daily Data**

| | |
|---|---|
| The Number of Daily Observations | 3231 |
| Surprise Federal Funds Rate Change (all days) | -0.001 (0.032) |
| S&P 500 index Stock Returns (%) (all days) | 0.001(0.029) |

Table 2 : The Impact of Monetary Policy on Stock Returns, Event Study Approaches.

| | Daily Data, Event Study | Intraday Data, Event Study |
|---|---|---|
| $\beta_1$ | **-4.880***(1.825)** | **-3.793***(1.388)** |

Notes: 1. Estimates of equation (5).

2. Window size for intraday data is 40 minutes, 10 minutes prior to 30 minutes post the FOMC announcement.

3. Parentheses contain robust standard errors.

4. *** indicates significant at the 1% confidence level; ** significant at 5%; * significant at 10 %.

Table 3: The Impact of Monetary Policy on Stock Returns, Thornton Methodology.

| | Thornton Methodology |
|---|---|
| $\beta_1$ | 1.439(1.917) |
| $\beta_2$ | **-6.652**(2.703)** |

Notes: 1. Estimates of equation (6).

2. Parentheses contain robust standard errors.

3. *** indicates significant at the 1% confidence level; ** significant at 5%; * significant at 10 %.

Table 4 : The Impact of Monetary Policy on Stock Returns in Bull and Bear Markets, Event Study Approaches

| | Daily Data, Event Study | Intraday Data, Event Study |
|---|---|---|
| $\beta_1$(The Impact in Bull ) | -3.063(1.904) | **-3.194*(1.699)** |
| $\beta_1 + \beta_2$(The Impact in Bear) | **-16.044***(5.078)** | **-6.011***(1.155)** |
| Difference P value | **0.018**** | 0.173 |

Notes: 1. Estimates of equation (7).

2. Parentheses contain robust standard errors.

3. *** indicates significant at the 1% confidence level; ** significant at 5%; * significant at 10 %.

Table 5 : The Impact of Monetary Policy on Stock Returns in Bull and Bear Markets, Thornton Methodology

| | Thornton Methodology |
|---|---|
| $\beta_1$ | -0.544(2.015) |
| $\beta_2$ | -2.915(2.856) |
| $\beta_3$ | 2.589(2.970) |
| $\beta_4$ | **-15.225***(5.808)** |
| | |
| $\beta_2$(The Impact in Bull) | -2.915(2.856) |
| $\beta_2 + \beta_4$ (The Impact in Bear) | **-18.140***(5.057)** |
| Difference P value | **0.009*** ** |

Notes: 1. Estimates for equation (8).

2. Parenthesis contains robust standard errors.

3. *** indicates significant at the 1% confidence level; ** significant at 5%; * significant at 10 %.

Table 6: The Impact of Monetary Policy on Stock Returns in Expansion and Recession Cycles, Event Study Approaches

| | Daily Data, Event Study | Intraday Data, Event Study |
|---|---|---|
| $\beta_1$ (The Impact in Expansion ) | **-4.378**(1.986)** | **-3.663**(1.628)** |
| $\beta_1 + \beta_2$ (The Impact in Recession) | **-9.186***(2.985)** | **-4.531***(0.637)** |
| Difference P value | 0.180 | 0.622 |

Notes:1. Estimates of equation (7).

2. Parentheses contain robust standard errors.

3. *** indicates significant at the 1% confidence level; ** significant at 5%; * significant at 10 %.

Table 7: The Impact of Monetary Policy on Stock Returns in Expansion and Recessions, Thornton Methodology

| | Thornton Methodology |
|---|---|
| $\beta_1$ | -0.707(2.479) |
| $\beta_2$ | -3.917(3.223) |
| $\beta_3$ | 3.094(3.197) |
| $\beta_4$ | **-8.572*(4.888)** |
| | |
| $\beta_2$(The Impact in Expansion ) | -3.917(3.223) |
| $\beta_2 + \beta_4$ (The Impact in Recession) | **-12.499***(3.676)** |
| Difference P value | **0.080*** |

Notes: 1. Estimates of equation (8).

2. Parentheses contain robust standard errors.

3. *** indicates significant at the 1% confidence level; ** significant at 5%; * significant at 10 %.